

# TECHNICAL INFORMATION



This section includes conversion factors, equivalents and formulas as they apply to golf course irrigation. The information is arranged by category to simplify and speed the process when making accurate calculations.



### AREAS

6.452 Sq. Centimeters	1 Sq. Inch
144 Sq. Inches	1 Sq. Foot
9 Sq. Feet	1 Sq. Yard
43,560 Sq. Feet	1 Acre
1 Acre	43,560 Sq. Feet
1 Acre	4,840 Sq. Yards
1 Acre	160 Sq. Rods
1 Sq. Rod	272.25 Sq. Feet
1 Sq. Rod	30.25 Sq. Yards
640 Acres	1 Sq. Mile
640 Acres	1 Section
Area of a Circle	Radius Squared x 3.1416
Area of a Square	One Side Squared
Area of a Triangle	½ Base x Altitude
Area of a Rectangle	Length x Width
Area of a Parallelogram	Base x Altitude

### LINEAL MEASUREMENTS

1 Centimeter	0.3937 Inches
1 Cubit	18 Inches
1 Meter	39.37 Inches
1 Rod	16.5 Feet
1 Rod	5.5 Yards
1 Chain	4 Rods
1 Chain	66 Feet
320 Rods	1 Mile
5280 Feet	1 Mile
Circumference of Circle	Diam. x 3.1416

### VOLUME

1728 Cubic Inches	1 Cubic Foot
231 Cubic Inches	1 Gallon
27 Cubic Feet	1 Cubic Yard
1 Cubic Foot	7.48052 Gallons (U.S.)
1 Cubic Yard	202 Gallons (U.S.)
16 Drams	1 Ounce
32 Ounces	1 Quart
4 Quarts	1 Gallon
1 Gallon	3.785 Liters
1 Gallon	0.00379 Cu. Meters
1 Gallon	0.833 Imperial Gal.
27,154 Gallons	1 Acre Inch
325,851 Gallons	1 Acre Foot
1,000,000 Gallons	3.0689 Acre Feet
1 Acre Foot	43,560 Cubic Feet
Volume of a Cube	Area of Base x Height
Volume of a Pyramid	½ Area of Base x Height
Volume of a Sphere	Diam. Cubed x 0.5236

### MASS/WEIGHT

1 kg	2.204 lbs
1 lb	454 g = 7000 grains
1 slug	14.5 kg
1 stone	14 lb

### WEIGHTS

1 U.S. Gallon (Water)	8.3357 lbs.
1 Cu. Foot (Water)	62.3554 lbs.
1 Imperial Gallon	10.0 lbs.
1 Liter	2.2 lbs.
Earth, in Place Undisturbed	100 lbs./cu.ft.
Earth, Dry and Loose	82-90 lbs./cu.ft.
Earth, Moist	75-100 lbs./cu.ft.
Sand, Dry	90-106 lbs./cu.ft.
Shale or Red Rock	162 lbs./cu.ft.
Limestone	160-163 lbs./cu.ft.
Base Gravel	12.0 lbs./sq. ft./inch Thick in Place
Asphalt	12.5 lbs./sq. ft./inch Thick in Place
Sack Cement	94 lbs.
Concrete (Plain)	140 lbs./cu.ft.
Concrete (Reinforced)	150 lbs./cu.ft.

### PRESSURES

1 Atmosphere	29.921 Inches of Hg @ 32° F
1 Atmosphere	33.94 Ft. of Water @ 62° F
1 Atmosphere	14.6963 lbs./Sq. Inch
1 Pound per Square Inch	2.31 Feet of Head
1 Foot of Water	0.433 lbs./Sq. Inch
1 Kilogram/Sq. Centimeter	14.22 lbs./Sq. Inch
1 Foot of Water	62.3554 lbs./Sq. Foot
1 Bar	14.5 lbs./Sq. Inch

### FLOWS

1 Gallon/Minute (U.S.)	0.002228 cu. ft./Second
1 Gallon/Minute (U.S.)	0.13368 cu. ft./Minute
1 Gallon/Minute (U.S.)	8.0208 cu. ft./Hour
1 Gallon/Minute (U.S.)	0.06309 Liters/Second
1 Gallon/Minute (U.S.)	3.78533 Liters/Minute
1 Gallon/Minute (U.S.)	0.0044192 Acre Ft./24 Hrs.
1 Gallon/Minute (U.S.)	0.22712 cu. Meters/Hr.
1 Cubic Ft. per Second	448.83 gpm
1 Liter per Second	15.85 gpm
1 Cubic Meter per Minute	264 gpm
1 Acre Inch per Hour	452.57 gpm
1 Acre Foot per Day	226.3 gpm
1,000,000 Gallons per Day	694.4 gpm
1 Cubic Ft. per Second	0.992 Acre Inches/Hr.

### POWER

Horsepower	$\frac{\text{gpm} \times \text{Total Head (Ft)}}{3960 \times \text{Pump Efficiency}}$
Pump Efficiency	$\frac{\text{gpm} \times \text{Total Head (Ft)}}{3960 \times \text{BHP to Pump}}$
1 Horsepower	33,000 Ft. lbs./Minute
1 Horsepower	746 Watts
1 Horsepower	0.746 Kilowatts

### TEMPERATURE

F	(1.8 x C) + 32
C	(F/1.8) - 32

### DISCHARGE FROM NOZZLES

U.S. (GPM)	METRIC (M <sup>3</sup> /H)	METRIC (LPS)
$gpm = \sqrt{P \times D^2 \times 29.82 \times C}$	$m^3/h = \sqrt{P \times D^2 \times 259,8 \times C}$	$lps = \sqrt{P \times D^2 \times 935,3 \times C}$
$D = \sqrt{\frac{gpm}{C \times \sqrt{P \times 29.82}}}$	$D = \sqrt{\frac{m^3/h}{C \times \sqrt{P \times 259,8}}}$	$D = \sqrt{\frac{lps}{C \times \sqrt{P \times 935,3}}}$
$P = \left[ \frac{gpm}{C \times D^2 \times 29.82} \right]^2$	$P = \left[ \frac{m^3/h}{C \times D^2 \times 259,8} \right]^2$	$P = \left[ \frac{lps}{C \times D^2 \times 935,3} \right]^2$
<i>gpm = Gallons per Minute</i>	<i>m<sup>3</sup>/h = Cubic Meters per Hour</i>	<i>lps = Liters per Second</i>
<i>D = Diameter of nozzle in inches</i>	<i>D = Diameter of nozzle in millimeters</i>	<i>D = Diameter of nozzle in millimeters</i>
<i>P = Pressure in pounds per square inch</i>	<i>P = Pressure in bars</i>	<i>P = Pressure in bars</i>
<i>C = Coefficient of discharge</i>	<i>C = Coefficient of discharge</i>	<i>C = Coefficient of discharge</i>

### PRECIPITATION

U.S. (GPM)	METRIC (M <sup>3</sup> /H)	METRIC (LPS)
$Pr. = \frac{gpm}{A}$	$Pr. = \frac{m^3/h \times 1000}{A}$	$Pr. = \frac{lps \times 3600}{A}$
$gpm = \frac{Pr. \times A}{96.3}$	$m^3/h = \frac{Pr. \times A}{96.3}$	$lps = \frac{Pr. \times A}{96.3}$
<i>Pr. = Precipitation in inches per hour</i>	<i>Pr. = Precipitation in inches per hour</i>	<i>Pr. = Precipitation in inches per hour</i>
<i>A = Area (distance between sprinklers on line x distance between lines)</i>	<i>A = Area (distance between sprinklers on line x distance between lines)</i>	<i>A = Area (distance between sprinklers on line x distance between lines)</i>
<i>gpm = Gallons per Minute per sprinkler</i>	<i>m<sup>3</sup>/h = Cubic Meters per Hour per sprinkler</i>	<i>lps = Liters per Second per sprinkler</i>

### VELOCITY

U.S.	METRIC
$V = \sqrt{\frac{P}{0.00674}}$	$V = \sqrt{\frac{P}{0.01419}}$
$P = 0.00674 \times V^2$	$P = 0.01419 \times V^2$
$V = \frac{gpm}{2.45 \times D^2}$	$P = \frac{9547 \times lps}{D^2}$
$V = \frac{2652 \times m^3/h}{D^2}$	$V = \frac{2652 \times m^3/h}{D^2}$
<i>V = Velocity in feet per second</i>	<i>V = Velocity in meters per second</i>
<i>P = Pressure in pounds per square inch</i>	<i>P = Pressure in bars</i>
<i>D = Diameter of pipe or nozzle in inches</i>	<i>D = Diameter of pipe or nozzle in millimeters</i>

**NOTES:**

- A column of water 1 foot high equals 0.4331 pounds pressure. (A column of water 1 meter high equals 0,098 bars.)
- 1 pound pressure equals a column of water 2.309 feet high. (1 bar pressure equals a column of water 10,20 meters high.)
- 1 acre equals 43,560 square feet.
- 1 acre inch equals 27,154 gallons.
- 1 cubic foot equals 7.48 gallons.
- 1 liter per second equals 15.85 gallons per minute.
- 1 m<sup>3</sup>/h equals 4.403 gallons per minute.
- 1 bar equals 14.50 psi (approximately 100 kPa).
- 1 millimeter equals 0.394 inches.
- The height of an equilateral triangle is 0.866 times its base.
- The discharge of a nozzle is in proportion to the square of its diameter and the square root of the pressure.

**POWER FORMULAS**

1 hp = 550 foot pounds per second  
= 746 watts or 0.746 kW  
= 1 second foot of water falling 8.8'

$$\text{Water hp} = \frac{\text{Second foot of water} \times \text{head in feet}}{8.8}$$

$$= \frac{\text{gpm of water} \times \text{head in feet}}{3960}$$

$$\text{Brake hp} = \frac{\text{Water hp}}{\text{Eff. of pump}}$$

1 kilowatt (kW) = 1000 watts  
= 1,341 hp  
= 735.5 foot pounds per second

**ELECTRICAL POWER**

$$3\phi \text{ KVA} = (1.732 \times \text{FLA} \times \text{Voltage}) / 1000$$

$$1\phi \text{ KVA} = (\text{FLA} \times \text{Voltage}) / 1000$$

**BRAKE HORSE POWER**

$$\text{BHP} = \frac{[\text{Pressure (in psi)} \times \text{Flow (in gpm)}]}{[1714 \times \text{Pump Efficiency (expressed as a decimal)}]}$$

**PUMP LAWS (AFFINITY LAWS)**

$$\begin{aligned} \text{RPM}_2 / \text{RPM}_1 &= \text{Flow}_2 / \text{Flow}_1 \\ (\text{RPM}_2 / \text{RPM}_1)^2 &= \text{Pressure}_2 / \text{Pressure}_1 \\ (\text{RPM}_2 / \text{RPM}_1)^3 &= \text{Power}_2 / \text{Power}_1 \end{aligned}$$

Example: A main coolant pump operating at 1800 RPM and producing 600 gpm at 120 psi is switched to 3600 RPM:

$$\begin{aligned} \text{RPM}_2 / \text{RPM}_1 &= \text{Flow}_2 / \text{Flow}_1 \\ &= 3600 \text{ RPM} / 1800 \text{ RPM} \\ &= \text{Flow}_2 / 600 \text{ gpm} = 1200 \text{ gpm} \end{aligned}$$

$$\begin{aligned} (\text{RPM}_2 / \text{RPM}_1)^2 &= \text{Pressure}_2 / \text{Pressure}_1 \\ &= (3600 \text{ RPM} / 1800 \text{ RPM})^2 \\ &= \text{Pressure}_2 / 120 \text{ psi} = 480 \text{ psi} \end{aligned}$$

$$\begin{aligned} (\text{RPM}_2 / \text{RPM}_1)^3 &= \text{Power}_2 / \text{Power}_1 \\ &= (3600 \text{ RPM} / 1800 \text{ RPM})^3 \\ &= \text{Power}_2 / 60 \text{ HP} = 480 \text{ HP} \end{aligned}$$

**CONDUCTOR PROPERTIES FOR INSULATED ANNEALED COPPER DIRECT CURRENT RESISTANCE — OHMS PER 1000 FEET**

COPPER AWG	TEMPERATURE (°F/°C)				CROSS SECTIONAL AREA (CIRCULAR MILS)
	167/75	149/65	77/25	68/20	
18 Solid	7.77	7.519	6.515	6.390	1,620
18 Stranded	7.95	7.693	6.666	6.538	1,620
16 Solid	4.89	4.732	4.100	4.021	2,580
16 Stranded	4.99	4.829	4.184	4.104	2,580
14 Solid	3.07	2.971	2.574	2.525	4,110
14 Stranded	3.14	3.039	2.633	2.582	4,110
12 Solid	1.93	1.868	1.618	1.587	6,530
12 Stranded	1.98	1.916	1.660	1.628	6,530
10 Solid	1.21	1.171	1.015	0.995	10,380
10 Stranded	1.24	1.200	1.040	1.020	10,380
8 Solid	0.764	0.739	0.641	0.628	16,510
8 Stranded	0.778	0.753	0.652	0.640	16,510
6 Stranded	0.491	0.475	0.412	0.404	26,240
4 Stranded	0.308	0.298	0.258	0.253	41,740
2 Stranded	0.194	0.188	0.163	0.160	66,360
1/0 Stranded	0.122	0.118	0.102	0.100	105,600
2/0 Stranded	0.097	0.094	0.081	0.080	133,100

Source: 2008 Edition of National Electric Code (NFPA 70), Chapter 9, Table 8.  
System designer must use resistance values which correlate to temperatures and applications for each specific project.



**PE 4710 IPS HDPE DR 13.5 (161 PSI) PIPE**

**VELOCITY IN FEET PER SECOND — FRICTION LOSS IN PSI PER 100 FEET (C = 150)**

NOMINAL SIZE (ID) FLOW (GPM)	2" (2.002)		3" (2.950)		4" (3.793)		6" (5.585)		8" (7.271)		10" (9.062)		12" (10.748)		14" (11.801)		16" (13.487)		18" (15.173)	
	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS
2	0.20	0.01	0.09	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.41	0.02	0.19	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.61	0.04	0.28	0.01	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.81	0.07	0.38	0.01	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	1.02	0.10	0.47	0.02	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	1.22	0.14	0.56	0.02	0.34	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	1.43	0.19	0.66	0.03	0.40	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	1.63	0.25	0.75	0.04	0.45	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	1.83	0.31	0.84	0.05	0.51	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	2.04	0.37	0.94	0.06	0.57	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	2.24	0.44	1.03	0.07	0.62	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	2.44	0.52	1.13	0.08	0.68	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	2.65	0.61	1.22	0.09	0.74	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	2.85	0.70	1.31	0.11	0.79	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	3.05	0.79	1.41	0.12	0.85	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	3.56	1.05	1.64	0.16	0.99	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40	4.07	1.35	1.88	0.20	1.13	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45	4.58	1.67	2.11	0.25	1.28	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	5.09	2.04	2.34	0.31	1.42	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55	5.60	2.43	2.58	0.37	1.56	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	6.11	2.85	2.81	0.43	1.70	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
65	6.62	3.31	3.05	0.50	1.84	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	7.13	3.80	3.28	0.58	1.99	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
75	7.63	4.31	3.52	0.65	2.13	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
80	8.14	4.86	3.75	0.74	2.27	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
85	8.65	5.44	3.99	0.82	2.41	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90	9.16	6.04	4.22	0.92	2.55	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100			4.69	1.11	2.84	0.33	1.31	0.05	0.77	0.01	0.50	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110			5.16	1.33	3.12	0.39	1.44	0.06	0.85	0.02	0.55	0.01	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00
120			5.63	1.56	3.40	0.46	1.57	0.07	0.93	0.02	0.60	0.01	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00
130			6.09	1.81	3.69	0.53	1.70	0.08	1.00	0.02	0.65	0.01	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
140			6.56	2.08	3.97	0.61	1.83	0.09	1.08	0.03	0.70	0.01	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150			7.03	2.36	4.25	0.69	1.96	0.11	1.16	0.03	0.75	0.01	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00
160			7.50	2.66	4.54	0.78	2.09	0.12	1.23	0.03	0.79	0.01	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
170			7.97	2.98	4.82	0.88	2.22	0.13	1.31	0.04	0.84	0.01	0.60	0.01	0.00	0.00	0.00	0.00	0.00	0.00
180			8.44	3.31	5.10	0.97	2.35	0.15	1.39	0.04	0.89	0.01	0.64	0.01	0.00	0.00	0.00	0.00	0.00	0.00
190			8.91	3.66	5.39	1.08	2.49	0.16	1.47	0.05	0.94	0.02	0.67	0.01	0.00	0.00	0.00	0.00	0.00	0.00
200			9.38	4.02	5.67	1.18	2.62	0.18	1.54	0.05	0.99	0.02	0.71	0.01	0.00	0.00	0.00	0.00	0.00	0.00
225			10.55	5.00	6.38	1.47	2.94	0.22	1.74	0.06	1.12	0.02	0.79	0.01	0.00	0.00	0.00	0.00	0.00	0.00
250			11.72	6.08	7.09	1.79	3.27	0.27	1.93	0.08	1.24	0.03	0.88	0.01	0.00	0.00	0.00	0.00	0.00	0.00
275			12.89	7.25	7.80	2.13	3.60	0.32	2.12	0.09	1.37	0.03	0.97	0.01	0.00	0.00	0.00	0.00	0.00	0.00
300			14.06	8.52	8.51	2.51	3.92	0.38	2.32	0.11	1.49	0.04	1.06	0.02	0.00	0.00	0.00	0.00	0.00	0.00
325			15.24	9.88	9.22	2.91	4.25	0.44	2.51	0.12	1.61	0.04	1.15	0.02	0.00	0.00	0.00	0.00	0.00	0.00
350			16.41	11.34	9.93	3.34	4.58	0.51	2.70	0.14	1.74	0.05	1.24	0.02	0.00	0.00	0.00	0.00	0.00	0.00
375				12.88	10.63	3.79	4.91	0.58	2.89	0.16	1.86	0.05	1.32	0.02	0.00	0.00	0.00	0.00	0.00	0.00
400				14.52	11.34	4.27	5.23	0.65	3.09	0.18	1.99	0.06	1.41	0.03	0.00	0.00	0.00	0.00	0.00	0.00
425				16.24	12.05	4.78	5.56	0.73	3.28	0.20	2.11	0.07	1.50	0.03	0.00	0.00	0.00	0.00	0.00	0.00
450				18.06	12.76	5.31	5.89	0.81	3.47	0.22	2.24	0.08	1.59	0.03	0.00	0.00	0.00	0.00	0.00	0.00
475				19.96	13.47	5.87	6.21	0.89	3.67	0.25	2.36	0.08	1.68	0.04	0.00	0.00	0.00	0.00	0.00	0.00
500					14.18	6.46	6.54	0.98	3.86	0.27	2.48	0.09	1.77	0.04	0.00	0.00	0.00	0.00	0.00	0.00
550					15.60	7.71	7.19	1.17	4.24	0.32	2.73	0.11	1.94	0.05	0.00	0.00	0.00	0.00	0.00	0.00
600					17.02	9.05	7.85	1.38	4.63	0.38	2.98	0.13	2.12	0.06	0.00	0.00	0.00	0.00	0.00	0.00
650					18.43	10.50	8.50	1.60	5.02	0.44	3.23	0.15	2.30	0.07	0.00	0.00	0.00	0.00	0.00	0.00
700					19.85	12.05	9.16	1.83	5.40	0.51	3.48	0.17	2.47	0.08	0.00	0.00	0.00	0.00	0.00	0.00
750					21.27	13.69	9.81	2.08	5.79	0.58	3.73	0.20	2.65	0.09	0.00	0.00	0.00	0.00	0.00	0.00
800									6.17	0.65	3.97	0.22	2.83	0.10	2.34	0.06	1.79	0.03	1.42	0.02
850									6.56	0.73	4.22	0.25	3.00	0.11	2.49	0.07	1.91	0.04	1.51	0.02
900									6.95	0.81	4.47	0.28	3.18	0.12	2.64	0.08	2.02	0.04	1.59	0.02
950									7.33	0.89	4.72	0.31	3.36	0.13	2.78	0.08	2.13	0.04	1.68	0.02
1000									7.72	0.98	4.97	0.34	3.53	0.15	2.93	0.09	2.24	0.05	1.77	0.03
1050									8.10	1.08	5.22	0.37	3.71	0.16	3.08	0.10	2.36	0.05	1.86	0.03
1100									8.49	1.17	5.47	0.40	3.89	0.18	3.22	0.11	2.47	0.06	1.95	0.03
1150									8.88	1.27	5.71	0.44	4.06	0.19	3.37	0.12	2.58	0.06	2.04	0.04
1200									9.26	1.38	5.96	0.47	4.24	0.21	3.52	0.13	2.69	0.07	2.13	0.04
1250									9.65	1.49	6.21	0.51	4.41	0.22	3.66	0.14	2.80	0.07	2.22	

**SDR 21 (CLASS 200) PVC PIPE**

**VELOCITY IN FEET PER SECOND — FRICTION LOSS IN PSI PER 100 FEET (C = 150)**

NOMINAL SIZE (ID) FLOW (GPM)	1" (1.189)		1¼" (1.502)		1½" (1.720)		2" (2.149)		2½" (2.601)		3" (3.166)		4" (4.072)		6" (5.993)		8" (7.805)		10" (9.728)		12" (11.538)	
	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS	VEL	LOSS
2	0.58	0.07	0.36	0.02	0.28	0.01	0.18	0.00	0.12	0.00	0.08	0.00	0.05	0.00	0.02	0.00	0.01	0.00	0.01	0.00	0.01	0.00
4	1.15	0.24	0.72	0.08	0.55	0.04	0.35	0.01	0.24	0.01	0.16	0.00	0.10	0.00	0.05	0.00	0.03	0.00	0.02	0.00	0.01	0.00
6	1.73	0.51	1.09	0.16	0.83	0.08	0.53	0.03	0.36	0.01	0.24	0.00	0.15	0.00	0.07	0.00	0.04	0.00	0.03	0.00	0.02	0.00
8	2.31	0.86	1.45	0.28	1.10	0.14	0.71	0.05	0.48	0.02	0.33	0.01	0.20	0.00	0.09	0.00	0.05	0.00	0.03	0.00	0.02	0.00
10	2.89	1.30	1.81	0.42	1.38	0.22	0.88	0.07	0.60	0.03	0.41	0.01	0.25	0.00	0.11	0.00	0.07	0.00	0.04	0.00	0.03	0.00
12	3.46	1.83	2.17	0.59	1.65	0.30	1.06	0.10	0.72	0.04	0.49	0.02	0.30	0.00	0.14	0.00	0.08	0.00	0.05	0.00	0.04	0.00
14	4.04	2.43	2.53	0.78	1.93	0.40	1.24	0.14	0.84	0.05	0.57	0.02	0.34	0.01	0.16	0.00	0.09	0.00	0.06	0.00	0.04	0.00
16	4.62	3.11	2.89	1.00	2.21	0.52	1.41	0.17	0.96	0.07	0.65	0.03	0.39	0.01	0.18	0.00	0.11	0.00	0.07	0.00	0.05	0.00
18	5.19	3.87	3.26	1.24	2.48	0.64	1.59	0.22	1.09	0.09	0.73	0.03	0.44	0.01	0.20	0.00	0.12	0.00	0.08	0.00	0.06	0.00
20	5.77	4.71	3.62	1.51	2.76	0.78	1.77	0.26	1.21	0.10	0.81	0.04	0.49	0.01	0.23	0.00	0.13	0.00	0.09	0.00	0.06	0.00
22	6.35	5.62	3.98	1.80	3.03	0.93	1.94	0.32	1.33	0.12	0.90	0.05	0.54	0.01	0.25	0.00	0.15	0.00	0.09	0.00	0.07	0.00
24	6.93	6.60	4.34	2.12	3.31	1.09	2.12	0.37	1.45	0.15	0.98	0.06	0.59	0.02	0.27	0.00	0.16	0.00	0.10	0.00	0.07	0.00
26	7.50	7.65	4.70	2.45	3.59	1.27	2.30	0.43	1.57	0.17	1.06	0.07	0.64	0.02	0.30	0.00	0.17	0.00	0.11	0.00	0.08	0.00
28	8.08	8.78	5.06	2.82	3.86	1.46	2.47	0.49	1.69	0.19	1.14	0.07	0.69	0.02	0.32	0.00	0.19	0.00	0.12	0.00	0.09	0.00
30	8.66	9.97	5.43	3.20	4.14	1.65	2.65	0.56	1.81	0.22	1.22	0.08	0.74	0.02	0.34	0.00	0.20	0.00	0.13	0.00	0.09	0.00
35	10.10	13.27	6.33	4.26	4.83	2.20	3.09	0.74	2.11	0.29	1.42	0.11	0.86	0.03	0.40	0.01	0.23	0.00	0.15	0.00	0.11	0.00
40	11.54	16.99	7.23	5.45	5.52	2.82	3.53	0.95	2.41	0.38	1.63	0.14	0.98	0.04	0.45	0.01	0.27	0.00	0.17	0.00	0.12	0.00
45			8.14	6.78	6.21	3.51	3.98	1.19	2.71	0.47	1.83	0.18	1.11	0.05	0.51	0.01	0.30	0.00	0.19	0.00	0.14	0.00
50			9.04	8.24	6.90	4.26	4.42	1.44	3.02	0.57	2.04	0.22	1.23	0.06	0.57	0.01	0.33	0.00	0.22	0.00	0.15	0.00
55			9.95	9.83	7.59	5.08	4.86	1.72	3.32	0.68	2.24	0.26	1.35	0.08	0.62	0.01	0.37	0.00	0.24	0.00	0.17	0.00
60			10.85	11.55	8.27	5.97	5.30	2.02	3.62	0.80	2.44	0.31	1.48	0.09	0.68	0.01	0.40	0.00	0.26	0.00	0.18	0.00
65			11.76	13.39	8.96	6.93	5.74	2.34	3.92	0.93	2.65	0.36	1.60	0.10	0.74	0.02	0.44	0.00	0.28	0.00	0.20	0.00
70					9.65	7.95	6.18	2.69	4.22	1.06	2.85	0.41	1.72	0.12	0.80	0.02	0.47	0.01	0.30	0.00	0.21	0.00
75					10.34	9.03	6.63	3.05	4.52	1.21	3.05	0.46	1.85	0.14	0.85	0.02	0.50	0.01	0.32	0.00	0.23	0.00
80					11.03	10.17	7.07	3.44	4.82	1.36	3.26	0.52	1.97	0.15	0.91	0.02	0.54	0.01	0.34	0.00	0.25	0.00
85					11.72	11.38	7.51	3.85	5.13	1.52	3.46	0.58	2.09	0.17	0.97	0.03	0.57	0.01	0.37	0.00	0.26	0.00
90							7.95	4.28	5.43	1.69	3.66	0.65	2.21	0.19	1.02	0.03	0.60	0.01	0.39	0.00	0.28	0.00
100							8.83	5.20	6.03	2.06	4.07	0.79	2.46	0.23	1.14	0.04	0.67	0.01	0.43	0.00	0.31	0.00
110							9.72	6.21	6.63	2.45	4.48	0.94	2.71	0.28	1.25	0.04	0.74	0.01	0.47	0.00	0.34	0.00
120							10.60	7.30	7.24	2.88	4.88	1.11	2.95	0.33	1.36	0.05	0.80	0.01	0.52	0.00	0.37	0.00
130									7.84	3.34	5.29	1.28	3.20	0.38	1.48	0.06	0.87	0.02	0.56	0.01	0.40	0.00
140									8.44	3.83	5.70	1.47	3.44	0.43	1.59	0.07	0.94	0.02	0.60	0.01	0.43	0.00
150									9.05	4.36	6.11	1.67	3.69	0.49	1.70	0.08	1.00	0.02	0.65	0.01	0.46	0.00
160									9.65	4.91	6.51	1.89	3.94	0.55	1.82	0.08	1.07	0.02	0.69	0.01	0.49	0.00
170									10.25	5.49	6.92	2.11	4.18	0.62	1.93	0.09	1.14	0.03	0.73	0.01	0.52	0.00
180									7.33	2.35	4.43	0.69	2.04	0.11	1.21	0.03	0.78	0.01	0.37	0.00	0.55	0.00
190									7.73	2.59	4.68	0.76	2.16	0.12	1.27	0.03	0.82	0.01	0.38	0.00	0.58	0.00
200									8.14	2.85	4.92	0.84	2.27	0.13	1.34	0.04	0.86	0.01	0.41	0.00	0.61	0.01
225									9.16	3.55	5.54	1.04	2.56	0.16	1.51	0.04	0.97	0.02	0.47	0.00	0.69	0.01
250									10.18	4.31	6.15	1.27	2.84	0.19	1.67	0.05	1.08	0.02	0.52	0.00	0.77	0.01
275									6.77	1.51	3.12	0.23	3.12	0.23	1.84	0.06	1.19	0.02	0.58	0.00	0.84	0.01
300									7.38	1.78	3.41	0.27	3.41	0.27	2.01	0.07	1.29	0.03	0.63	0.00	0.92	0.01
325									8.00	2.06	3.69	0.31	3.69	0.31	2.18	0.09	1.40	0.03	0.68	0.00	1.00	0.01
350									8.61	2.36	3.98	0.36	3.98	0.36	2.34	0.10	1.51	0.03	0.73	0.01	1.07	0.01
375									9.23	2.68	4.26	0.41	4.26	0.41	2.51	0.11	1.62	0.04	0.78	0.01	1.15	0.02
400									9.84	3.03	4.54	0.46	4.54	0.46	2.68	0.13	1.72	0.04	0.83	0.01	1.23	0.02
425									10.46	3.38	4.83	0.52	4.83	0.52	2.85	0.14	1.83	0.05	0.88	0.01	1.30	0.02
450											5.11	0.57	5.11	0.57	3.01	0.16	1.94	0.05	0.93	0.01	1.38	0.02
475											5.40	0.63	5.40	0.63	3.18	0.18	2.05	0.06	0.98	0.01	1.46	0.03
500											5.68	0.70	5.68	0.70	3.35	0.19	2.16	0.07	1.03	0.01	1.53	0.03
550											6.25	0.83	6.25	0.83	3.68	0.23	2.37	0.08	1.13	0.01	1.69	0.03
600											6.82	0.98	6.82	0.98	4.02	0.27	2.59	0.09	1.23	0.01	1.84	0.04
650											7.38	1.13	7.38	1.13	4.35	0.31	2.80	0.11	1.33	0.01	1.99	0.05
700											7.95	1.30	7.95	1.30	4.69	0.36	3.02	0.12	1.43	0.01	2.15	0.05
750											8.52	1.48	8.52	1.48	5.02	0.41	3.23	0.14	1.53	0.01	2.30	0.06
800											9.09	1.67	9.09	1.67	5.36	0.46	3.45	0.16	1.63	0.01	2.45	0.07
850											9.66	1.86	9.66	1.86	5.69	0.52	3.66	0.18	1.73	0.01	2.61	0.08
900											10.22	2.07	10.22	2.07	6.03	0.57	3.88	0.20	1.83	0.01	2.76	0.09
950															6.36	0.63	4.10	0.22	1.93	0.01	2.91	0.09
1000															6.70	0.70	4.31	0.24	2.03	0.01	3.06	0.10
1050															7.03	0.76	4.53	0.26	2.13	0.01	3.22	0.11
1100															7.37	0.83	4.74	0.28	2.23	0.01	3.37	0.12
1150															7.70	0.90	4.96	0.31	2.33	0.01	3.52	0.13
1200															8.04	0.98	5.17	0.33	2.43	0.01	3.68	0.15
1250															8.37	1.05	5.39	0.36	2.53	0.01	3.83	0.16
1																						

PRESSURE CONVERSION				
PSI	FEET	METER	BAR	kPa
1	2.3090	0.7038	0.0689	6.8948
80	185	56	5.5	552
85	196	60	5.9	586
90	208	63	6.2	621
95	219	67	6.6	655
100	231	70	6.9	689
105	242	74	7.2	724
110	254	77	7.6	758
115	266	81	7.9	793
120	277	84	8.3	827
125	289	88	8.6	862
130	300	91	9.0	896
135	312	95	9.3	931
140	323	99	9.7	965
150	346	106	10.3	1034
160	369	113	11.0	1103
170	393	120	11.7	1172
180	416	127	12.4	1241
190	439	134	13.1	1310
200	462	141	13.8	1379

FLOW RATE CONVERSION				
GPM	ft <sup>3</sup> /s	m <sup>3</sup> /h	l/s	acre-ft/day
1	0.0022	0.2271	0.0002	0.004419
100	0.22	22.7	6.3	0.442
250	0.56	56.8	15.8	1.105
500	1.11	113.6	31.5	2.210
750	1.67	170.3	47.3	3.314
1000	2.23	227.1	63.1	4.419
1500	3.34	340.7	94.6	6.629
2000	4.46	454.2	126.2	8.838
2500	5.57	567.8	157.7	11.048
3000	6.68	681.4	189.3	13.258
3500	7.80	794.9	220.8	15.467
4000	8.91	908.5	252.4	17.677
4500	10.03	1022.1	283.9	19.886
5000	11.14	1135.6	315.5	22.096
6000	13.37	1362.7	378.5	26.515
7000	15.60	1589.9	441.6	30.934
8000	17.82	1817.0	504.7	35.353
9000	20.05	2044.1	567.8	39.773
10000	22.28	2271.2	630.9	44.192

HORSEPOWER TO KILOWATTS			
HORSEPOWER	KILOWATT	HORSEPOWER	KILOWATT
1	0.746	25	18.7
3	2.2	30	22.4
5	3.7	40	29.8
10	7.5	50	37.3
15	11.2	60	44.8
20	14.9	75	56.0

LAKE INTAKE BOX SCREEN SIZING	
FLOW RATE IN GPM	BOX SCREEN SIZE
0 - 500	18" square
501 - 1000	24" square
1001 - 1800	30" square
1801 - 2800	36" square
2801 - 4000	42" square
4001 - 5000	48" square
5001 - 7000	54" square
7001 - 8500	60" square
8501 - 10000	66" square

Based on screen velocities of less than 0.5 feet per second

WET WELL INTAKE PIPE SIZING					
FLOW RATE IN GPM	LENGTH OF PIPE IN FEET				NOMINAL IPS PIPE DIAMETER
	50'	100'	200'	300'	
0 - 500	12"	12"	12"	14"	
501 - 1000	18"	18"	18"	18"	
1001 - 1500	24"	24"	24"	24"	
1501 - 2000	26"	26"	26"	26"	
2001 - 2500	28"	28"	28"	28"	
2501 - 3000	30"	30"	30"	30"	
3001 - 3500	32"	32"	32"	32"	
3501 - 4000	34"	34"	34"	34"	
4001 - 5000	36"	36"	36"	36"	

The nominal IPS pipe diameters listed in this chart assume a total equivalent pipe length as listed for friction loss calculations. A recommended internal pipe water velocity of up to 1.5 feet per second and/or a draw down of 1 inch or less is used to develop this conservative intake sizing table. Consult a Rain Bird engineer for values ranging outside of this chart.

WET WELL OPEN AREA SIZING		
SIZE	SHAPE	NUMBER OF PUMPS
36" DIA	ROUND	1 - Vertical Turbine
48" DIA	ROUND	1 or 2 - Vertical Turbines
60" DIA	ROUND	1 or 2 - Vertical Turbines
72" DIA	ROUND	1 to 3 - Vertical Turbines
84" DIA	ROUND	1 to 5 - Vertical Turbines
96" DIA	ROUND	1 to 6 - Vertical Turbines
6' X 8'	RECTANGULAR	1 to 7 - Vertical Turbines

FULL LOAD AMPERAGE (FLA)					
MOTOR HP	SINGLE PHASE A-C		THREE PHASE A-C INDUCTION TYPE SQUIRREL CAGE & WOUND ROTOR		
	115 VOLTS	230 VOLTS**	230 VOLTS**	460 VOLTS	575 VOLTS
1/2	9.8	4.9	2.2	1.1	0.9
3/4	13.8	6.9	3.2	1.6	1.3
1	16	8	4.2	2.1	1.7
1 1/2	20	10	6.0	3.0	2.4
2	24	12	6.8	3.4	2.7
3	34	17	9.6	4.8	3.9
5	56	28	15.2	7.6	6.1
7 1/2	80	40	22	11	9
10	100	50	28	14	11
15			42	21	17
20			54	27	22
25			68	34	27
30			80	40	32
40			104	52	41
50			130	65	52
60			154	77	62
75			192	96	77
100			240	120	96
125			296	148	118
150			350	175	140
200			456	228	182
250			558	279	223

\*\*For 208V applications, increase the FLA by 10%

To calculate the FLA of a pump motor operating on a VFD, multiply the nominal FLA by 1.24

To estimate FLA, multiply the largest load by 1.25 and then add this to remaining component FLAs.

Example: a 460V 2 x 50HP pump station with a 5HP PM pump would have an FLA of 173.4 Amps.

$$173.4 \text{ Amps} = 1.24 \times 1.25 \times 65A + 65A + 7.6A$$

### WIRE PATH DESIGN

Recommended to Load Balance Wire Path.

- Do not utilize the full system capacity of 750 ICMs on one wire path. Instead, leave room to expand the system and add sensing capability in the future.

The wire distance is the “trunk length” of the wire path.

- The trunk length is the “longest single run of wire” needed for accommodating the installed ICMs.

Branches can be added to the trunk wire.

- Branches do not increase the maximum number of ICMs on the wire path.

WIRE DISTANCE IN METERS (M)															
NO. OF UNITS	1,000	1,250	1,500	1,750	2,000	2,250	2,500	2,750	3,000	3,250	3,500	3,750	4,000	4,250	4,500
50	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>
100	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>
150	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>
200	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>
250	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>
300	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>
350	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>
400	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	3.0mm <sup>2</sup>
450	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>
500	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>
550	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>
600	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>
650	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>
700	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	5.0mm <sup>2</sup>
750	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	2.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	3.0mm <sup>2</sup>	5.0mm <sup>2</sup>	5.0mm <sup>2</sup>

WIRE DISTANCE IN FEET (FT.)															
NO. OF UNITS	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000	12,000	13,000	14,000	15,000
50	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG
100	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG
150	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG
200	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG
250	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG
300	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG
350	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG
400	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG
450	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG
500	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG
550	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG
600	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG
650	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG
700	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	10 AWG
750	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	10 AWG	10 AWG

WATER VELOCITY TABLE																								
GPM	INTERNAL PIPE DIAMETER																							
	2"	4"	6"	8"	10"	12"	14"	16"	18"	20"	22"	24"	26"	28"	30"	32"	34"	36"	38"	40"	42"	44"	46"	48"
10	1.0	0.3	0.1	0.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20	2.0	0.5	0.2	0.1	0.1	0.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	3.1	0.8	0.3	0.2	0.1	0.1	0.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
40	4.1	1.0	0.5	0.3	0.2	0.1	0.1	0.1	0.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
50	5.1	1.3	0.6	0.3	0.2	0.1	0.1	0.1	0.1	0.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
60	6.1	1.5	0.7	0.4	0.2	0.2	0.1	0.1	0.1	0.1	0.1	—	—	—	—	—	—	—	—	—	—	—	—	—
70	7.2	1.8	0.8	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	—	—	—	—	—	—	—	—	—	—	—	—	—
80	8.2	2.0	0.9	0.5	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	—	—	—	—	—	—	—	—	—	—	—	—
90	9.2	2.3	1.0	0.6	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	—	—	—	—	—	—	—	—	—	—	—
100	10.2	2.6	1.1	0.6	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	—	—	—	—	—	—	—	—	—	—
150	15.3	3.8	1.7	1.0	0.6	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	—	—	—	—	—	—	—
200	20.4	5.1	2.3	1.3	0.8	0.6	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	—	—	—	—
250	25.5	6.4	2.8	1.6	1.0	0.7	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	—	—
300	30.7	7.7	3.4	1.9	1.2	0.9	0.6	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
350	35.8	8.9	4.0	2.2	1.4	1.0	0.7	0.6	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
400	40.9	10.2	4.5	2.6	1.6	1.1	0.8	0.6	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
450	46.0	11.5	5.1	2.9	1.8	1.3	0.9	0.7	0.6	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
500	51.1	12.8	5.7	3.2	2.0	1.4	1.0	0.8	0.6	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
600	61.3	15.3	6.8	3.8	2.5	1.7	1.3	1.0	0.8	0.6	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1
700	71.5	17.9	7.9	4.5	2.9	2.0	1.5	1.1	0.9	0.7	0.6	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
800	81.7	20.4	9.1	5.1	3.3	2.3	1.7	1.3	1.0	0.8	0.7	0.6	0.5	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1
900	92.0	23.0	10.2	5.7	3.7	2.6	1.9	1.4	1.1	0.9	0.8	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
1000	102.2	25.5	11.4	6.4	4.1	2.8	2.1	1.6	1.3	1.0	0.8	0.7	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2
1250	127.7	31.9	14.2	8.0	5.1	3.5	2.6	2.0	1.6	1.3	1.1	0.9	0.8	0.7	0.6	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2
1500	153.3	38.3	17.0	9.6	6.1	4.3	3.1	2.4	1.9	1.5	1.3	1.1	0.9	0.8	0.7	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.3
1750	178.8	44.7	19.9	11.2	7.2	5.0	3.6	2.8	2.2	1.8	1.5	1.2	1.1	0.9	0.8	0.7	0.6	0.6	0.5	0.4	0.4	0.4	0.3	0.3
2000	204.4	51.1	22.7	12.8	8.2	5.7	4.2	3.2	2.5	2.0	1.7	1.4	1.2	1.0	0.9	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.4
2500	255.4	63.9	28.4	16.0	10.2	7.1	5.2	4.0	3.2	2.6	2.1	1.8	1.5	1.3	1.1	1.0	0.9	0.8	0.7	0.6	0.6	0.5	0.5	0.4
3000	306.5	76.6	34.1	19.2	12.3	8.5	6.3	4.8	3.8	3.1	2.5	2.1	1.8	1.6	1.4	1.2	1.1	0.9	0.8	0.8	0.7	0.6	0.6	0.5
3500	357.6	89.4	39.7	22.4	14.3	9.9	7.3	5.6	4.4	3.6	3.0	2.5	2.1	1.8	1.6	1.4	1.2	1.1	1.0	0.9	0.8	0.7	0.7	0.6
4000	408.7	102.2	45.4	25.5	16.3	11.4	8.3	6.4	5.0	4.1	3.4	2.8	2.4	2.1	1.8	1.6	1.4	1.3	1.1	1.0	0.9	0.8	0.8	0.7
4500	459.8	114.9	51.1	28.7	18.4	12.8	9.4	7.2	5.7	4.6	3.8	3.2	2.7	2.3	2.0	1.8	1.6	1.4	1.3	1.1	1.0	0.9	0.9	0.8
5000	510.9	127.7	56.8	31.9	20.4	14.2	10.4	8.0	6.3	5.1	4.2	3.5	3.0	2.6	2.3	2.0	1.8	1.6	1.4	1.3	1.2	1.1	1.0	0.9
5500	562.0	140.5	62.4	35.1	22.5	15.6	11.5	8.8	6.9	5.6	4.6	3.9	3.3	2.9	2.5	2.2	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.0
6000	613.1	153.3	68.1	38.3	24.5	17.0	12.5	9.6	7.6	6.1	5.1	4.3	3.6	3.1	2.7	2.4	2.1	1.9	1.7	1.5	1.4	1.3	1.2	1.1

Main line pipe diameter under standard practice is sized to achieve < 5 feet-per-second water velocity.  
 Wet-well intake pipe diameter under standard practice is sized to achieve < 1.5 feet-per-second water velocity.  
 Velocities listed are based on the actual internal diameter for the pipe. Verify internal diameter based on class or type of pipe being used.

Rain Bird will repair or replace at no charge any Rain Bird professional product that fails in normal use within the warranty period stated below. You must return it to the dealer or distributor where you bought it.

This commitment to repair or replace is our sole and total warranty. **Implied warranties of merchantability and fitness, if applicable, are limited to one year from the date of sale. We will not, under any circumstances, be liable for incidental or consequential damages, no matter how they occur.**

## I. TURF PRODUCTS

Falcon® Series rotors, 5000 Series rotors, 1800™ Series pop-up spray heads, U-Series nozzles, brass MPR nozzles, A-8S and PA-8S-PRS shrub adapters and 1300 and 1400 bubblers, RSD-BEx and RSD-CEx — five years.

Lake Management Aerator: LM10, LM11, LM20, LM30 — five years

Lake Management Aerator: LMM — two years

Lake Management Aerator Lights — one year

Commercial Pump Stations — 12 months from the start-up or 16 months from the date of shipment

## II. GOLF PRODUCTS

Golf Rotors: TG-25, DR, DH, DS, EAGLE™ Series and EAGLE IC™ Series Golf Rotors — three years. Additionally, any TG-25, DR, DH, DS, EAGLE, or EAGLE IC™ Series Golf Rotors sold and installed in conjunction with a Rain Bird swing joint — five years. Proof of concurrent installation is required.

Swing Joints — five years

Brass and Plastic Valves: EFB and PE-B Remote Control Valves, EFB and PE-B IC™ Series Remote Control Valves, and Brass Quick Coupling Valves and Keys — three years

Filtration system controllers — three years

LINK Radios — three years

Lake Management Aerator: LM10, LM11, LM20, LM30 — five years

Lake Management Aerator: LMM — two years

Lake Management Aerator Lights — one year

Hose Reels — two years

Pump Stations and Filtration — one year from date of start-up or 16 months from date of invoice. Any maintenance or repairs performed without pre-authorization by Rain Bird voids the Policy.

All other golf products — one year

## III. AGRICULTURAL PRODUCTS

PC Dripline — three years

Rain Guns — three years (in agricultural applications only)

Disk Filters — one year

Pressure Gauges — one year

All agricultural products — two years

## IV. PUMP STATIONS AND FILTRATION

One year on most pump stations. Please see the Pump Station Professional Satisfaction Policy Terms and Conditions for details. The Pump Station Professional Satisfaction Policy Terms and Conditions are available from your authorized Rain Bird Distributor.

## V. ALL OTHER PRODUCTS — ONE YEAR

## VI. ADDENDUM:

In freezing climates, it is necessary to properly prepare the installed system in winter shutdown in order to minimize the potential for freeze damage.

Rain Bird cannot and does not warranty against damage to equipment caused by lightning or electrical surges.

**PRICE CHANGES:** Prices are subject to change without notice.

**DESIGN CHANGES:** Rain Bird Corporation reserves the right to redesign, alter or modify its products without incurring any liability from anyone's inventory of such parts or products that may become obsolete.